UTE LADIES'-TRESSES (*Spiranthes diluvialis*)

AGENCY REVIEW DRAFT

RECOVERY PLAN

Prepared by the Ute Ladies'-Tresses Recovery Team

for

Region 6
U.S. Fish and Wildlife Service
Denver, Colorado

Approved: _____

Date: _____

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LITERATURE CITATIONS

Literature Citation should read as follows:

U.S. Fish and Wildlife Service. 1995. Ute ladies'-tresses (Spiranthes diluvialis) recovery plan. U.S. Fish and Wildlife Service, Denver, Colorado. 46 pp.

ACKNOWLEDGMENTS

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The Recovery Team would like to acknowledge and express appreciation to the interagency technical work group that authored the Bull Trout Conservation Strategy. That strategy inspired many of the concepts described in this recovery plan.

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EXECUTIVE SUMMARY

Current Status: The Ute ladies'-tresses (Spiranthes diluvialis) is an orchid that occurs in relatively low elevation riparian, spring, and lakeside wetland meadows in three general areas of the interior western United States: near the base of the eastern slope of the Rocky Mountains in southeastern and central Wyoming and north-central and central Colorado, and Montana; in the upper Colorado River basin, particularly in the Uinta Basin; and along the Wasatch Front and westward in the eastern Great Basin, in north-central and western Utah and extreme eastern Nevada. The total population is approximately 20,500 individuals. The riparian and wetland habitats required by this species have been heavily impacted by urban development, stream channelization, water diversions and other watershed and stream alterations that reduce the natural dynamics of stream systems, recreation, and invasion of habitat by exotic plant species. These activities are expected to intensify, threatening remaining Ute ladies'-tresses populations and habitats.

Habitat Requirements and Limiting Factors: The Ute ladies'-tresses is endemic to moist soils in mesic or wet meadows near springs, lakes, or perennial streams. The elevational range of known Ute ladies'-tresses occurrences is 4,300 and 7,000 feet (1,310 to 2,134 meters). Most of the occurrences are along riparian edges, gravel bars, old oxbows, and moist to wet meadows along perennial streams, but some localities in the eastern Great Basin are in similar situations near freshwater lakes or springs. Ute ladies'-tresses seem to require "permanent sub-irrigation", indicating a close affinity with floodplain areas where the water table is near the surface throughout the growing season and into the late summer or early autumn. The orchid occurs primarily in areas where the vegetation is relatively open and not overly dense or overgrown, although a few populations in eastern Utah and Colorado are found in riparian woodlands. Plants usually occur in small scattered groups and occupy relatively small areas within the riparian system. These preferred habitat features imply that the orchid requires early to mid-seral riparian habitats created and maintained by streams active within their floodplains. Suitable orchid habitat is being reduced in area and becoming increasingly fragmented due to conversion of land to urban and suburban uses and certain water and stream system management practices associated with municipal, agricultural, and recreational uses. The naturally small size and scattered distribution of Ute ladies'-tresses populations makes the species particularly vulnerable to the effects of habitat fragmentation and overall decline of suitable habitat.

Recovery Objective: The continued existence of the Ute ladies'-tresses along a stream system and in floodplain wet meadows requires either 1) direct manipulation of habitat to maintain necessary hydrologic and vegetation community conditions or 2) assurance of the continual creation and evolution of favorable habitat conditions resulting from natural stream dynamics. Of these options, the latter, ensuring the conditions that allow natural stream dynamics to create and maintain preferred orchid habitat, is in the long run the most dependable and ecologically desirable way to guarantee the viability of the orchid in perpetuity. Recovery objectives for the Ute ladies'-tresses include:

1. Obtaining information on life history, demographics, habitat requirements, and watershed processes that will allow specification of management and population goals and monitoring progress.

2. Managing watersheds to perpetuate or enhance viable populations of the orchid.

3. Protecting and managing Ute ladies'-tresses populations in wet meadow, seep, and spring habitats.

Actions Needed:

1. Define, manage, and restore watersheds, using watershed-based interagency, interdisciplinary teams as evaluation and planning aids.

2. Implement interim recovery actions for orchid populations associated with natural stream systems until watershed interdisciplinary teams are able to conduct evaluations and make planning and management recommendations.

3. Identify, protect, and manage populations that occur in wet meadow, seep, and spring sites.

4. Develop orchid population and habitat recovery goals and delisting criteria incorporating information from watershed evaluations and genetic, life history, ecology, and habitat management studies.

5. Inventory remaining potential habitat.

6. Conduct genetic, life history, ecology, and habitat management studies.

7. Reintroduce orchids into appropriate sites.

8. Conduct public education on watershed and riparian area management, use of recovery and interdisciplinary teams, and orchid ecology.

Date of Recovery: Unknown

Total Cost of Recovery: Unknown

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PART I INTRODUCTION

The Ute ladies'-tresses (Spiranthes diluvialis) was listed as a threatened species on January 17, 1992 (57 FR 2053) under the authority of the Endangered Species Act of 1973 (Act), as amended. The U.S. Fish and Wildlife Service (Service) is responsible for preparing a recovery plan and guiding actions that will restore populations and remove threats such that the species no longer requires protection under the Act and can be removed from the list of threatened species. This recovery plan describes recovery goals and discusses how they may be achieved so that the Ute ladies'-tresses can be removed from the list of threatened plants.

A. Description

S. diluvialis is a perennial, terrestrial orchid with stems 20 to 50 cm (8 to 20 inches) tall, arising from tuberously thickened roots. Its narrow (1.0 cm (.39 inches)) leaves can reach 28 cm (11 inches) long. Basal leaves are longest and become reduced in size up the stem. The flowers consist of few to many small white or ivory flowers clustered into a spike arrangement at the top of the stem. The species is characterized by whitish, stout, ringent (gaping at the mouth) flowers. The sepals and petals, except for the lip are rather straight, although the lateral sepals are variably oriented, these often spreading abruptly from the base of the flower; sepals are free to the base. The rachis is pubescent with the longest trichomes 0.2 mm (0.008 inches) long or longer, usually much longer. It blooms, generally, from late July through August. However, depending on location and climatic conditions, Ute ladies'-tresses may bloom in early July or may still be in flower as late as early October.

B. Taxonomy

Prior to the description of S. diluvialis in 1984, workers in Orchidaceae had tried to accommodate specimens from the West in three taxa of white-flowered Spiranthes orchids: Spiranthes cernua L.C. Richard, Spiranthes romanzoffiana Chamisso, and Spiranthes porrifolia Lindley.

In 1980, a specimen of Spiranthes was collected near Golden, Colorado, that appeared to be S. cernua. In 1981, live plants were collected at that site and sent to Dr. Charles J. Sheviak, who initiated studies on the genus Spiranthes in the early 1970's, for examination. In 1982 and 1983, Dr. Sheviak visited Colorado and Utah. After examining herbarium specimens and live specimens in the field and after cytologic study, Dr. Sheviak was convinced that the Colorado-Utah plants were a new species, which he described in 1984 (Sheviak 1984). The type locality is along Clear Creek west of Golden.

In his original description, Sheviak (1984) suggested that S. diluvialis resulted from the hybridization of Spiranthes magnicamporum and S. romanzoffiana during a Pleistocene pluvial period when the region supported lush grasslands and the two parent species would have been sympatric or parapatric. Under a cooler and wetter climate, S. romanzoffiana would have

occurred at lower elevations. As the climate became drier, the boreal S. romanzoffiana retreated to higher elevations and S. magnicamporum retreated to the eastern Great Plains. S. diluvialis persisted in warm wet situations, eventually becoming more limited to scattered areas of permanent moisture.

Morphologically, S. diluvialis is intermediate between its putative progenitors. S. romanzoffiana is a montane plant of moist areas along streams and near lakes, rarely found below 2,438 meters (8,000 feet) in Colorado, and widely distributed across the northern part of the continent and in the western mountains to Arizona. S. romanzoffiana has a tight helix of inflated, ascending flowers around the spike, lateral appressed sepals, and a pandurate lip. S. magnicamporum is a plains plant of moist areas, which has nodding, tubular flowers, with free and ascending lateral sepals, and an ovate to lanceolate lip. The center of distribution of S. magnicamporum is in the Midwest, ranging from Texas to North Dakota. Disjunct populations in the Rio Grande Valley of New Mexico may indicate a once larger distribution for the species. S. diluvialis has flowers facing directly away from the stalk, neither ascending nor nodding, appressed or free lateral sepals, and a lip intermediate in shape between those of the putative parents.

See Appendix I for further discussion on Ute ladies'-tresses taxonomy.

C. Distribution

Populations of S. diluvialis occur in relatively low elevation riparian, spring, and lakeside wetland meadows in three general areas of the interior western United States: near the base of the eastern slope of the Rocky Mountains in southeastern Wyoming and north-central and central Colorado; in the upper Colorado River basin, particularly in the Uinta Basin; and along the Wasatch Front and westward in the eastern Great Basin, in north-central and western Utah and extreme eastern Nevada. In 1994, the known range was expanded northward by discoveries in central Wyoming and western Montana. Figure 1 shows the distribution of the Ute ladies'-tresses orchid in the western United States excluding the Montana occurrence.

The eastern most large populations are located in mesic riparian meadows of relict tall-grass prairie and irrigated pastures near South Boulder Creek at the southeast edge of Boulder, Boulder County, Colorado, and in mesic meadows in the riparian woodland understory along Clear Creek in adjacent Jefferson County, Colorado.

The largest populations are managed by the City of Boulder Open Space Department and the City of Wheat Ridge, Colorado. A few plants are known from the lower reaches of Clear Creek Canyon, west of Golden, significantly upstream from the larger populations near Golden and Wheat Ridge. Smaller populations are currently known from private land along St. Vrain Creek, near Hygiene, Boulder County (discovered 1992); on property owned by Colorado State University near the Cache La Poudre River at the northwest edge of Fort Collins, Weld County (discovered 1993); and on state-owned land along Bear Creek, Goshen County, Wyoming (discovered 1993). Historic collections were made in 1856 along the South Platte River, most likely near the mouth of Crow

In preparation

Figure 1. Distribution of current and historical occurrences of the Ute ladies'-tresses (S. diluvialis) in Nevada, Utah, Colorado, and Wyoming as of June, 1994. Discoveries made during the 1994 field season in Wyoming and Montana are not included.

Creek; and in 1896 at Camp Harding in southwest suburban Colorado Springs, El Paso County (Jennings 1989, 1990).

Two populations discovered in 1994 expand the known range of the Ute ladies'-tresses considerably to the north. One population was found along Antelope Creek, a tributary to the Cheyenne River, in northwest Converse County, Wyoming (E. Nelson, Rocky Mountain Herbarium, in litt. 1994). One population was discovered in an old meander scar of the Jefferson River in Jefferson County, Montana (B. Heidel, Montana Natural Heritage Program, in litt. 1994). Both of these discoveries are in the Missouri River drainage.

The central populations of the orchid are in wet or mesic riparian meadows or in understory wetland meadows of riparian woodlands in the Colorado River drainage of eastern Utah.

Several populations occur along the Green River below Flaming Gorge dam: two on Federal lands administered by the Bureau of Land Management and one on private land in Browns Park in Daggett County; one in Island Park; and one south of the Split Mountain Gorge, the latter two within Dinosaur National Monument. Additional populations occur within Dinosaur National Monument on small tributaries to the Green River: one in Hog Canyon, one in adjacent Cub Creek and one in Orchid Draw.

S. diluvialis populations occur on all the major drainages to the Green River along the south slope of the Uinta Mountains in the northern portion of the Uinta Basin. A small population occurs along Brush Creek on Bureau of Land Management lands. Two populations occur in the Ashley Creek drainage: a small population on private land adjacent to Ashley Creek, and a large population in wetlands recently developed in an abandoned gravel pit on Federal lands administered by the Bureau of Reclamation. A large population occurs along the Uinta River and its tributary, the Whiterocks River, primarily on Ute tribal lands. Populations occur along the Lake Fork River above its confluence with the Yellowstone River, mostly on private lands. A large population occurs along the Duchesne River from the vicinity of its confluence with the Strawberry River upstream to the lower portion of Rock Creek, mostly on private lands. A small population occurs on private lands along Currant Creek, a tributary of the Strawberry River.

Outside of the Uinta Basin, two small outlier populations exist in the Colorado River Basin in south-central Utah. One small population occurs along the Fremont River in Capitol Reef National Park, Wayne County and the second larger population on Bureau of Land Management administered lands along Deer Creek, near Boulder, Garfield County. All Colorado River Basin populations have been discovered since 1977 (Coyner 1989, 1990; Heil 1988; Jennings 1989; U.S. Fish & Wildlife Service 1991; Franklin 1993).

The western-most populations of S. diluvialis occur in riparian, spring, and lakeside wet or mesic meadows along the Wasatch Front and in the eastern Great Basin of western Utah and adjacent Nevada. Two are in wetlands on private land adjacent to Utah Lake in Utah County, Utah. In 1992, several orchid populations were discovered on the Uinta National Forest in the Spanish Fork River drainage, primarily along the Diamond Fork tributary. Smaller stands

occur downstream on private land adjacent to Spanish Fork (Stone 1993). In 1993, these locations were revisited and the populations along the Diamond Fork River were found to be quite large (L. Gecy, RMI, in litt. 1994). A small population has been located along the Provo River near Heber City, Wasatch County. A small population occurs at Willow Springs, near the desert community of Callao, Tooele County (Doug Stone, Utah Natural Heritage Program, pers. comm. 1994).

Four additional populations are known historically, but are believed to be extirpated. Specimens were collected in Ogden, Weber County, in 1887, but plants have not been relocated (Sheviak 1984). In Salt Lake County, plants were observed in wetlands near the Jordan River as recently as 1953 and in Red Butte Canyon in 1966. Near the town of Panaca, Lincoln County, Nevada, plants were seen in 1936 in a wet meadow in the drainage of Meadow Valley Wash. Recent searches for these populations have been fruitless (Coyner 1989, 1990; Jennings 1989, 1990; U.S. Fish & Wildlife Service 1991; Stone 1993).

The population sizes as of the most recent census are shown in Table 1 for each watershed in which the Ute ladies'-tresses occurs.

Table 1. Approximate population size of the Ute ladies'-tresses as indicated by the number of flowering individuals. Numbers are from the most recent censuses available for each watershed.

WATERSHED	POPULATION SIZE
West Desert	1
Duchesne	4,600
Mainstem Green	1,600
Dirty Devil	2
Escalante	500
Utah Lake	7,000
Boulder Creek/St. Vrain	5,500
Clear Creek	1,200
Cache/Poudre River	13
Horse Creek	16
Cheyenne River	24
Jefferson River	71
TOTAL*	20,500

* Rounded to nearest 100

In addition to the known range of the species, it is possible that undiscovered populations occur elsewhere in Wyoming (southeastern quarter, along the Green River upstream of Flaming Gorge Reservoir, along the Laramie Divide, along the Powder River and tributaries, and along the Cheyenne River), Colorado (Pawnee grasslands area in the northeast, west slope - especially northwest portion, and along the base of the Front Range between Fort Collins and Pueblo), Montana (Missouri River tributaries such as the Jefferson and Yellowstone Rivers), and Utah/Nevada/Idaho (Uinta Basin, north of the Wasatch Front along tributaries, such as the Bear River, flowing westward toward the Great Salt Lake or Snake River in Idaho, low elevation wetlands in western Utah and Nevada in similar habitat to the Callao occurrence and the historical occurrence at Panaca).

D. Life History/Demography

Very little is known about the life history and demography of the Ute ladies'-tresses. Research was initiated in 1991 at Dinosaur National Monument and in 1986 at City of Boulder Open Space to learn about life history, demographics, habitat requirements, and habitat management. The following information includes preliminary results from that research and associated literature searches, as well as observations from others who have worked with the orchid over some years.

Orchids generally have very small seeds requiring specific symbiotic associations with mycorhizal fungi for germination (Arditti 1992). Many species of Spiranthes are initially saprophytic, underground plants that persist for many years before leaves emerge above ground. The mycorhizal stage is reported to last for 8 years in Spiranthes spiralis, and green leaves are first produced 11 years after germination (Wells 1967, 1981). The fungal associate may still play an important role in the survival of mature plants. Nutrients derived from a fungal symbiont may allow some orchid species to remain underground without above ground growth for one year or longer. S. spiralis individuals rarely flower in consecutive years or under unfavorable conditions, and may survive due to their relationship with mycorhizal fungi (Wells 1981). S. diluvialis may have a similar life history (Tamara Naumann, City of Boulder Open Space Department, pers. comm. 1991). Observations of individually monitored Ute ladies'-tresses plants in Utah and Colorado have demonstrated that a plant can remain dormant (without above ground growth) for at least one growing season (Arft 1993, Lynn Riedel, National Park Service, in litt., 1993). Studies of S. magnicamporum in western Kansas and Nebraska report that the orchid may bloom as rarely as once in 20 years (Magrath 1973). The mean expected life span (longevity) of S. spiralis plants studied by Wells (1967) over a nine year period was calculated to be more than 50 years.

Vegetative plants average between 10-15 cm in height, but can reach up to 35 cm. The inflorescence begins to emerge in June or July and can reach 12-45 cm tall, producing tubular white flowers arranged in a spiral. The orchid typically begins flowering at the end of July and continues until early September, depending upon moisture and light conditions. Shaded plants tend to flower later. Fruit set occurs in late August through September (Jennings 1990, Arft 1993). At the end of the growing season, small (0.5-2 cm) leaf rosettes often emerge at the base of orchid plants and persist through the

winter months. Two or more plants often occur in clumps. It is not known whether these clumps are composed of separate individuals or whether all arise from a single underground organ.

Reproduction appears to be strictly sexual, with bumble bees (Bombus spp.) as the primary pollinators (Dresler 1981, Sheviak 1984, Sipes et al., 1993). Flowers are protandrus (functionally male first and then female). The inflorescence always begins blooming with the bottom flower and proceeds upwards, sequentially. These features tend to maximize outcrossing due to the tendency of bees to visit the bottommost flower first and then proceed vertically up the spike. Successful conservation of the orchid will require protecting pollinator habitat in and around orchid populations and suitable habitat.

The apparent tendency for populations of the Ute ladies'-tresses to fluctuate dramatically from one year to the next makes it difficult to assess the population status and distribution. Due to the difficulty in finding vegetative individuals, monitoring is typically done by counting the number of flowering individuals. Monitoring at the Van Vleet population by the City of Boulder Open Space Department has been conducted since its discovery in 1986, with the exception of 1991. During that time, apparent population size, as indicated by the number of flowering individuals, has gone from a high of 5,435 in 1986 to a low of 1,137 in 1989 (Arft 1993).

Previous work by Wells (1981) on S. spiralis indicated that population size did not fluctuate when both flowering and vegetative plants were surveyed. Preliminary results examining both vegetative and flowering individuals at the Van Vleet site and at Dinosaur National Monument suggest that population size of the Ute ladies'-tresses is more stable than indicated by monitoring only flowering individuals (Arft 1993, Riedel 1992).

Research is necessary to elucidate the early life history stages of the Ute ladies'-tresses (from seed dispersal to seedling emergence and from seedling emergence to mature reproducing individual), identify limiting or vulnerable stages, and understand factors influencing successful completion of each life history stage. No matter what the original cause(s) of reductions in population that resulted in listing as a federally threatened species, improving population status will require identifying vulnerable and limiting life history stages and implementing measures to enhance the successful passage of individuals through those stages (Schemske et al. 1994).

E. Habitat/Ecology

S. diluvialis is endemic to moist soils in mesic or wet meadows near springs, lakes, or perennial streams. The elevational range of known orchid occurrences is 4,300 and 7,000 feet (1,310 to 2,134 meters) (Stone 1993). Most of the occurrences are along riparian edges, gravel bars, old oxbows, and moist to wet meadows along perennial streams, but some localities in the eastern Great Basin are in similar situations near freshwater lakes or springs (U.S. Fish and Wildlife Service 1991). Jennings (1990) and Coyner (1989, 1990) observed that the orchid seems to require "permanent sub-irrigation", indicating a close affinity with floodplain areas where the water table is

near the surface throughout the growing season and into the late summer or early autumn. This observation has been corroborated by ground water monitoring research conducted in Dinosaur National Monument (Martin & Wagner 1992) and in Boulder, Colorado (Tamara Naumann, pers. comm. 1993).

Ute ladies'-tresses occur primarily in areas where the vegetation is relatively open and not overly dense or overgrown (Coyner 1989, 1990 and Jennings 1989, 1990). A few populations in eastern Utah and Colorado are found in riparian woodlands, but the orchid seems generally intolerant of shade, preferring open, grass and forb-dominated sites instead. Plants usually occur as small scattered groups and occupy relatively small areas within the riparian system (Stone 1993). Common associated species in the eastern range (Colorado's Front Range) of the orchid include Agalinis tenuifolia, Agrostis stolonifera, Asclepias incarnata, Calamagrostis spp., Cirsium arvense, Equisetum spp., Lobelia siphilitica, Sisyrinchium spp., Solidago spp., Triglochin spp., and Verbena hastata. In the central section of the orchid's range (the Uinta Basin), common associated species are Agrostis stolonifera, Calamagrostis spp., Carex spp., Cirsium spp., Dactylis glomerata, Epipactis gigantea, Equisetum spp., Oenothera elata, Prunella vulgaris, Salix exigua, and Solidago canadensis. Species commonly associated with the orchid in the western part of the range (the Wasatch Front and the eastern Great Basin) include Agrostis stolonifera, Alnus incana, Aster hesperius, Carex spp., Castilleja exilis, Cirsium arvense, Equisetum laevigatum, Juncus spp., Melilotus spp., Populus angustifolia, Salix spp., Solidago occidentalis, and Trifolium pratense.

Soils typically range from fine silt/sand to gravels and cobbles. The orchid is sometimes found in highly organic or peaty soils. It is not found in heavy or tight clay soils or in extremely saline or alkaline soils (pH >8.0).

The orchid appears to be well adapted to disturbances caused by water movement through floodplains over time (Tamara Naumann, pers. comm. 1992, Lynn Riedel, pers. comm. 1994). It often grows on point bars and other recently created or "raw" riparian habitat. It is tolerant of flooding and flood disturbance. For example, point bars and backwater areas (old oxbows, side channels, etc.) are often flooded for several months in the spring during snowmelt. At least one-third of the Hog Canyon population is buried under flood debris (1 to 8 cm of sandy debris was deposited by an August, 1993 flood) every few years (Lynn Riedel, pers. comm. 1994).

Once established, the orchid appears to be tolerant of somewhat drier conditions (Riedel 1992), but loses vigor and may gradually die out if the groundwater table begins to consistently drop during late summer (Riedel 1992, Anna Arft, University of Colorado, pers. comm. 1994).

Some of the sites where the orchid occurs have a history of and are currently managed for agricultural uses, typically late winter and early spring grazing and mowing for hay. These sites may be naturally wet meadows or may be supplied with irrigation water.

The habitat alteration resulting from agricultural use (such as from mowing, grazing, and burning) may be beneficial, neutral, or detrimental to the orchid

(McClaren and Sundt, 1992). In Colorado, the largest population of the orchid is on City of Boulder Open Space at the Van Vleet site, a floodplain meadow, which has been used agriculturally for the past 50-75 years. This site is still grazed each year in the winter from February to May, irrigated in the spring and early summer, and mown in the summer around the beginning of July. When these activities were discontinued at a similar site in Boulder, exotic species such as Canada thistle proliferated and the orchid disappeared. Resumption of traditional agricultural uses has since reduced the thistle infestation and the orchid has reappeared (Tamara Naumann, pers. comm. 1994). Grazing and mowing seem to promote flowering, presumably by opening the canopy to admit more sunlight. However, these management practices may impede fruit set by directly removing flowering stalks, enhancing conditions for herbivory of fruits by small mammals such as meadow voles, or altering habitat required by bumble bees, the primary pollinator (Arft 1993).

What is known about the habitat preferences of the Ute ladies'-tresses is consistent with the following model for natural population establishment and maintenance. This model is based upon observations and recent research since listing the Ute ladies'-tresses as a threatened species:

Ute ladies'-tresses habitat is found along freshwater streams emerging from the flanks of mountains where the streambed is beginning to level out and meander within a developing floodplain. These streams are very dynamic. They are subject to seasonal flooding from snowmelt and intermittent heavy thunderstorms. Due to variations in snowpack, these streams experience fairly frequent severe (overbank) flooding sufficient to cause movement of the stream channel within its floodplain.

The orchid colonizes early successional riparian habitats such as point bars, sand bars, and low lying gravelly, sandy, or cobbly edges. As the stream channel changes location and depth, the orchid persists in those areas where the hydrology provides continual dampness in the rooting zone throughout the growing season. These areas include old oxbows, side channels, or older stream channels that have been filled in with alluvial material but which still have a hydrologic connection, through groundwater, to the stream system.

The orchid is tolerant of a mix of wetland forb and grass species, is not tolerant of long term standing water, and does not compete with emergent plant species (e.g., cattails) or aggressive species that form dense monocultures such as Canada thistle or reed canarygrass.

Throughout the historical range of the orchid, the lower mountain flanks and associated riparian areas provide winter range for native ungulates. It is likely that late winter and early spring grazing by native ungulates (bison, elk, and deer along the Front Range, big horn sheep, elk, and deer along the south slope of the Uintas and west slope of the Wasatch Range) in riparian areas historically helped maintain the vegetation community in a condition favorable for the orchid (i.e., prevented excessive buildup of live and dead vegetation). Native ungulates typically follow the snowline (greenline) upslope as spring arrives, thus historically did not stay in orchid habitat in large numbers throughout the summer. Predators also likely kept native

ungulates from excessive congregation in riparian habitats throughout the year.

As the stream channel continues to change over time, becoming deeper relative to an orchid site due to downcutting or sediment deposition or moving laterally farther away from an orchid site, seasonal hydrology also changes so that an orchid site experiences drier conditions. This causes the vegetation community to become dominated by upland grass and forb species. With time, riparian trees may establish and shade orchid sites as well. Under these conditions, the orchid is less competitive and begins to die out.

Ute ladies'-tresses are expected to be scattered along stream systems and associated floodplain areas with appropriate hydrology. A particular orchid occurrence will persist as long as hydrologic and vegetation community conditions remain favorable. The longevity of an orchid occurrence at any particular location likely ranges from a few years to more than 100 years. Thus, over decades, it may not be possible to determine exactly where an orchid population will be encountered along a stream because the stream channel and associated riparian area will always be changing. However, as long as these dynamic conditions continue, the orchid will dependably occur along the stream system where favorable habitat is found.

As mentioned, the model described above is consistent with what is now known about the habitat preferences of the Ute ladies'-tresses. However, many populations of the orchid, particularly those along the Front Range of Colorado, exist under habitat conditions that are maintained by management activities such as irrigation and grazing rather than by natural stream processes. Other populations occur in association with isolated seeps and springs. Many aspects of this model have yet to be verified. It is expected that this model will be refined as new information becomes available through ongoing and proposed research.

Based on this model, the continued existence of the orchid along a stream system requires either (1) direct manipulation of habitat to maintain necessary hydrologic and vegetation community conditions (e.g., by irrigation or stream channel manipulation, and mowing, grazing, or other vegetation management methods) or (2) assurance of the continual creation and evolution of favorable habitat conditions resulting from natural stream dynamics. Of these options, the latter, ensuring the conditions that allow natural stream dynamics to create and maintain preferred orchid habitat, is in the long run the most dependable and ecologically desirable way to guarantee the viability of the orchid in perpetuity.

F. Reasons for Listing

Orchid species are never common. The Ute ladies'-tresses historically occurred over a wide range but was distributed as scatterings of small populations in suitable habitat within this range. It never dominated local vegetation communities. As previously described, the orchid depends upon natural stream processes, and likely also natural ungulate population levels and behavior, to create and maintain habitat. Both of these environmental

features have been dramatically altered since settlement of the west by Europeans. Ungulate populations have been driven from winter range by agricultural activities and urban development. Orchid habitat is now grazed by cows, sheep, or horses, and both timing and intensity are different, than grazing patterns of native ungulates. Stream processes have also been severely altered. Reservoirs, dams, and diversions have removed water from stream systems, completely dewatering some reaches, and changed their hydrographs (magnitude and timing of flow). Streams have been channelized, streambanks rip-rapped, and floodplains converted for agriculture or urban development. The Ute ladies'-tresses continues to survive either where streams are still in a somewhat natural condition within a floodplain, or where conditions mimic naturally created and maintained habitat. For example, the orchid can be found along old gravel pits that have been restored as wetlands, in irrigated pastures, and below leaky diversion dams and irrigation canals.

Urbanization is one of the primary threats to the orchid. Urbanization continues to expand along streams and within floodplains. Both undeveloped habitat and agricultural areas near where the orchid exists or where it could exist are being converted to urban and suburban land uses. This is limiting the distribution of habitats sufficient to support viable populations as well as restricting the range of the species. Colorado's Front Range and Utah's Wasatch Front are two of the fastest growing urban areas in the nation. The orchid has been extirpated from some areas along the Wasatch Front and the Front Range. For example, except for two small populations in wetlands near Utah Lake and the recently discovered population along Diamond Fork, all known historic populations of the orchid along the Wasatch Front are presumed extirpated, as are all but one (rediscovered in 1994) in the eastern Great Basin. Two of the four historic populations in Colorado are also extirpated (Coyner 1989, 1990; Jennings 1989, 1990, U.S. Fish and Wildlife Service 1991). The conversion of potential habitat is occurring at a rapid, and increasing, pace.

Increasing demand for water, both for agriculture and for municipal and industrial uses, is also a severe threat to the orchid. In Colorado and Utah, water developers are planning water projects on most of the remaining undammed streams or stream reaches. Water is managed to optimize urban and agricultural uses. Water law and precedent, and water development interests, make it difficult to retain or reinstitute instream flows, particularly flows that mimic or reflect natural hydrographs.

Recreational uses of streams and riparian areas are increasing as nearby urban populations increase. Management of streams for introduced game fish by moderating stream dynamics to produce even rather than varying flows and low sediment loads may impede creation and maintenance of orchid habitat. Recreational uses within riparian areas can trample orchids, cause compaction resulting in changes in hydrology, and encourage proliferation of weedy species. Although it is possible in some cases to manage streams to accommodate both the orchid and recreational activities including game fishing, efforts to do so have not been seriously initiated to date.

Invasion of exotic species into orchid habitat poses a serious threat to the species' viability. The Ute ladies'-tresses does not tolerate dense competing vegetation. In the large Boulder populations, unchecked Canada thistle growth prevents orchids from flowering and reproducing. Other exotic species common to Ute ladies'-tresses habitat that cause similar detrimental effects include purple loosestrife (Lythrum salicaria), whitetop (Cardaria spp.), Russian olive (Eleagnus angustifolia), and reed canarygrass (Phalaris arundinaceae).

The orchid's pattern of distribution as small, scattered, groups and its restricted habitat make it vulnerable to both natural and human-caused disturbances. Localized catastrophic events have the potential to extirpate individual populations. It is not known if many of the species' smaller scattered populations are of sufficient size to ensure their continued existence over the long term, particularly the populations in Capitol Reef National Park along the Fremont River (2 individuals in 1993), at Willow Springs, Utah (1 individual found) and along Bear Creek in Wyoming (16 individuals).

The Ute ladies'-tresses appears to have a very low reproductive rate under natural conditions (Coyner 1991). Many orchid species take 5 to 10 years to reach reproductive maturity, and this is probably true for S. diluvialis. Reproductively mature plants do not flower every year. These life history and demographic features make the species more vulnerable to the combined impacts of localized extirpations, diminishing potential habitat, increasing distance between populations, and decreasing population sizes (Belovsky et al., 1994).

The present condition of the Ute ladies'-tresses is indicative of the health and condition of watersheds and streams throughout its range. Other species dependent upon the same habitats, for example native fish and amphibian species, are also in trouble. Appropriate watershed and stream management can be beneficial to many species, not just the Ute ladies'-tresses, while improving other watershed functions such as water quality.

G. Conservation Measures

Many conservation measures have already been undertaken for this rare orchid, including expanded inventories, research projects, land management efforts, and development of regulatory mechanisms.

Inventory. Inventories for the species have been or are being conducted in Utah, Colorado, Nevada, Wyoming, and Montana. These inventories have resulted in several new discoveries or relocations of historic occurrences, including: every major drainage in the Uinta Basin (Franklin 1993); the Diamond Fork and Spanish Fork Rivers (Stone 1993, L. Gecy, RMI, in litt., 1994), and along the Provo River (Robert Johnson, Dugway Proving Grounds, pers. comm. 1994) on the Wasatch Front; at Willow Springs in Utah's west desert (eastern Great Basin) (Doug Stone, pers. comm. 1994); along St. Vrain Creek (Steven Peterson, Western Resource Development, pers. comm. 1993), upstream in Clear Creek (Chris Pague, Colorado Natural Heritage Program, pers. comm. 1993) and in the Cache La Poudre River drainage (K. Manci, City of Fort Collins, in litt., 1993) in Colorado's Front Range; and in the Bear Creek drainage in Wyoming (Ernie Nelson, Rocky Mountain Herbarium, pers. comm. 1994). These discoveries

have improved our understanding of the orchid's historic range and habitat preferences.

Research. The following research projects have been initiated and are underway to increase our knowledge of the Ute ladies'-tresses:

1. Pollination biology - USDA Bee Biology and Systematics Laboratory at Utah State University.

2. Seed germination, propagation, and transplanting - University of Colorado and Center for Plant Conservation membership institutions: Red Butte Gardens, Salt Lake City, and Denver Botanic Gardens.

3. Genetic analysis - University of Colorado at Boulder.

4. Demographics and life history - Dinosaur National Monument, City of Boulder Open Space Department, University of Colorado at Boulder, Colorado Natural Areas Program, and Utah Natural Heritage Program.

5. Habitat requirements and management - Dinosaur National Monument, City of Boulder Open Space Department, University of Colorado at Boulder, and Colorado Natural Areas Program.

Management. Management activities include both Federal and local government efforts. The Bureau of Land Management, the Forest Service, the National Park Service, and the Bureau of Reclamation all manage lands where the Ute ladies'-tresses grows. The orchid also occurs on Ute tribal land with Bureau of Indian Affairs management responsibilities. These Federal agencies are responsible for insuring that all activities and actions on lands they manage are not likely to jeopardize the continued existence of the Ute ladies'-tresses. The National Park Service and the Bureau of Land Management have initiated population monitoring. The Forest Service is preparing a Conservation Agreement for the Diamond Fork area.

The National Park Service has supported orchid research and special management projects in Dinosaur National Monument since 1990. A population biology study and habitat restoration project is ongoing in a significant occurrence (Hog Canyon) of the Ute ladies'-tresses in the Cub Creek drainage in eastern Utah. Orchid population dynamics are being studied through long-term monitoring of several hundred permanently marked plants. Research investigating the relationship between ground-water level, stream-water level, soil moisture and orchid presence and viability is ongoing. The small perennial tributary to Cub Creek which provides orchid habitat has been restored to a natural position within its floodplain where the orchid occurs. The restoration project focuses on a stream section that was artificially incised early in the century. Pre- and post- stream relocation data have been collected to monitor the effects of habitat restoration on the orchid. The National Park Service in cooperation with other agencies expects to continue long-term orchid monitoring and inventory in Dinosaur National Monument.

The City of Boulder Open Space Department actively manages for the Ute ladies'-tresses in areas where it is known or expected to occur. Management

activities include: restricting the use of chemicals and using integrated weed management (biological control, late spring grazing) on exotic species that encroach on or threaten orchid habitat; retaining and monitoring the impact of historic agricultural practices such as grazing, irrigation, and haying; and maintaining a separate layer in the GIS computer system on orchid locations to aid in planning Open Space activities. The Open Space Department supports monitoring and research activities including annual surveys of potential habitat and annual population counts. In addition, the Open Space Department provides support for graduate research on demographics, genetics, and environmental requirements of the orchid and conducts educational programs about the orchid for local organizations, school groups, and public citizens.

Mitigation and habitat rehabilitation associated with the Central Utah Project may provide opportunities for protecting, enhancing, or recreating orchid habitat and providing suitable sites for reintroduction.

Regulatory. In 1992, the Service developed interim survey procedures for selected areas of Colorado as part of the Endangered Species Act section 7 consultation process. These procedures state that all projects requiring a Federal permit or receiving Federal funding that may disturb potential orchid habitat must be surveyed for the presence of the orchid. As a result of these procedures, three additional occurrences have been discovered, along the St. Vrain River, in the Cache La Poudre River drainage near Fort Collins, and farther upstream along Clear Creek. These new occurrences are all within the known historical range of the species, but significantly extend the current range.

The Service also requires surveys for the orchid on a site by site basis in Utah. Surveys in association with the Central Utah Project have led to the discovery of the Provo River population and provided additional information on the population size and distribution along the Diamond Fork and Spanish Fork Rivers.

In 1995, the Service developed new section 7 consultation procedures for the species throughout it known range to help ensure that unknown occurrences are not inadvertently destroyed.

As a member of the family Orchidaceae, S. diluvialis is included on the CITES Appendix II list. Species on Appendix II require a permit from the country of origin prior to export. International trade in this species is likely minimal.

PART II RECOVERY

A. Objective

Description and Rationale. This recovery plan seeks to address Ute ladies'-tresses recovery by maintaining and restoring the ecological processes that create and maintain good orchid habitat. It describes a process for watershed level planning and management designed to achieve the goal of maintaining and restoring watershed conditions for the long-term persistence of the orchid throughout its known historical range. This is an attempt to interpret and define "ecosystem management" and apply it to the recovery of a species. The focus on watershed level planning and management is necessary because it is watershed conditions and processes that create and maintain habitat for the orchid. Many other species of special concern are affected by watershed conditions and management, and their needs can be coordinated with and met through efforts made to recover the Ute ladies'-tresses. For natural viability, the orchid is considered to require, and to be, an indicator species of streams in a state of dynamic equilibrium with their physical settings. Therefore, accomplishment of Ute ladies'-tresses population goals is expected to require management of streams and their watersheds consistent with natural stream flows and hydrography, stream gradients, soils, etc. Both population levels and amount of suitable habitat for the orchid within a watershed are expected to fluctuate over time.

Recovery of the Ute ladies'-tresses and removal from the list of endangered and threatened species will be accomplished when it is demonstrated that:

1. Viable populations throughout its historic range and representative of its genetic endowment are maintained in riparian habitats of streams in a state of dynamic equilibrium.

2. Wet meadow, seep, and spring habitats are protected and managed so as to sustain viable populations.

The objectives of this recovery plan are to determine the number, size, and distribution of viable populations, level of protection, and watershed and habitat management practices required to achieve recovery of the orchid and establish procedures and processes for accomplishing recovery goals.

This recovery plan does not set specific population goals (Task 1.6) for the Ute ladies'-tresses at this time because:

1. Population levels and viability are determined by habitat conditions created and maintained by natural watershed processes. Therefore, the significance of population size and distribution within a watershed can only be assessed in terms of the ability of the watershed to perpetuate it. Recovery targets must include certain habitat and watershed factors as well as orchid population size. However, the linkages between watershed processes, habitat conditions, and population response are complex and not completely understood. As more information is obtained,

targets for watershed and habitat factors, as well as goals for population size and distribution within watersheds, will be set.

2. The locations of populations within a watershed vary with the availability of suitable habitat. Assuming there is more than one population within a watershed (to serve as a source of seeds), the natural demise or extirpation of a population at one location is significant only if watershed processes are insufficient to create and maintain habitat conditions suitable for the establishment of new populations.

3. Populations fluctuate naturally. Some years not a single individual appears aboveground. Therefore, population goals alone cannot be used as an indication of species viability.

4. Almost nothing is known about the life history and demographics of the Ute ladies'-tresses. Mature flowering adults are the only life history stage visible and easily used for population assessment. However, the number of flowering adults does not give an accurate picture of population size nor tell us anything about population structure. More information is necessary before accurate measures of population viability can be devised and targets set.

Because of these factors, the following recovery goals have been identified for the ladies'-tresses:

1. Obtain necessary information on life history, demographics, habitat requirements, and watershed processes;

   a. develop a better understanding of the relationship between habitat conditions and population response;

   b. develop a better understanding of the relationship between watershed processes and desired habitat conditions;

   c. elucidate Ute ladies'-tresses life history, specifically, how, in what time frame, and under what conditions a seed develops into a mature flowering adult.

   d. understand Ute ladies'-tresses demography, specifically, (1) what are the most vulnerable life history stages, (2) what factors contribute to that vulnerability, and (3) what is the age structure or composition of viable populations and how can it be measured or assessed.

2. Manage key watersheds to perpetuate or enhance viable populations of the orchid. Specific watershed, habitat, and population goals for delisting the Ute ladies'-tresses will be determined as information from the first goal is obtained.

3. Protect and manage Ute ladies'-tresses populations that occur in wet meadow, seep, and spring habitats.

Of these 3 goals, goal 2, key watershed management, is the most complex and potentially difficult to achieve. Nevertheless, Ute ladies'-tresses recovery and delisting will not be possible unless this goal is accomplished. Therefore, the focus of this recovery plan is on watershed management for orchid recovery.

There is growing recognition among conservation biologists working with fisheries and aquatic systems that the evolutionarily significant unit is at a landscape, i.e., watershed or larger, scale. Watershed level planning and management with a goal of reestablishing natural processes and dynamics is the only approach that will retain important native fishes such as salmonids (Reeves et al, 1994, Grossman 1994). As riparian areas are intimately and inseparably connected with aquatic systems, these concepts are equally applicable to management and conservation of riparian habitats and species.

Other species that will benefit from improved watershed function include various native fish species and riparian-dependent species such as amphibians, neotropical migratory birds, and raptors. Within the orchid's historical range, listed and candidate species include:

Green River and mainstem Colorado River

Bonytail chub (Gila elegans)	Endangered
Colorado squawfish (Ptychocheilus lucius)	Endangered
Humpback chub (G. cypha)	Endangered
Razorback sucker (Xyrauchen texanus)	Endangered
Boreal toad (Bufo boreas boreas)	Candidate
Bald eagle (Haliaeetus leucocephalus)	Threatened

Bonneville Basin

June sucker (Chasmistes liorus)	Endangered
Least chub (Iotichthys phlegethontis)	Candidate
Spotted frog (Rana pretiosa)	Candidate
Utah valvata snail (Valvata utahensis)	Endangered
Bald eagle (Haliaeetus leucocephalus)	Threatened

North and South Platte River Basins

Pallid sturgeon (Scaphirhynchus albus)	Endangered
Sturgeon chub (Macrhybopsis gelida)	Candidate
Greenback cutthroat trout (Oncorhynchus clarki stomias)	Threatened
Whooping crane (Grus americana)	Endangered
Piping plover (Charadrius melodus)	Threatened
Bald eagle (Haliaeetus leucocephalus)	Threatened
Peregrine falcon (Falco peregrinus anatum)	Endangered
Eskimo curlew (Numenius borealis)	Endangered
Least tern (Sterna antillarum)	Endangered
Wyoming toad (Bufo hemiophrys baxteri)	Endangered
Boreal toad (Bufo boreas boreas)	Candidate
Preble's meadow jumping mouse (Zapus hudsonius preblei)	Candidate

In recent years, Federal resource management agencies have initiated planning and management efforts for native fisheries resources and watershed and riparian area management. For example, the Bureau of Land Management is guided by its "Riparian-Wetland Initiative for the 1990's" (U.S.D.I. Bureau of Land Management 1990) and "Riparian Area Management - Process for Assessing Proper Functioning Condition" (Prichard 1993). The Forest Service has undertaken efforts to inventory and classify riparian areas, conduct experimental management in riparian areas with particular focus on grazing and recreation, and provide training to Forest Service staff and other agencies on riparian area and watershed management and function. In response to the Northern spotted owl controversy, President Clinton created three interagency working groups, one of which was the Forest Ecosystem Management Assessment Team (FEMAT) composed of representatives from the Forest Service, National Marine Fisheries Service, Bureau of Land Management, National Park Service, Environmental Protection Agency, and Fish and Wildlife Service. This team was charged with using an ecosystem approach to forest management. Their report developed and described concepts, terminology, and approaches to use in managing aquatic and riparian resources based on a watershed-level perspective (Forest Ecosystem Management Assessment Team 1993). Following that effort, the Bureau of Land Management and the Forest Service together prepared an environmental assessment or managing anadromous fish-producing watersheds in areas of Oregon, Washington, Idaho, and California not covered in the FEMAT document (U.S.D.A. Forest Service and U.S.D.I Bureau of Land Management, 1994). The assessment incorporated the concepts, terminology, and approach developed by FEMAT. A further application of ecosystem management at the watershed level applied to conservation of a species was the Pre-Decisional Draft Working Document Conservation Strategy for Bull Trout (Salvelinus confluentus) prepared by an interagency technical work group (Interagency Technical Group 1994). The concept of more comprehensive watershed level management is being recognized at the executive level with a Presidential Task Force review of the Mississippi River flooding of 1993 (Galloway 1994), and at the congressional level as part of the current debate surrounding reauthorization of the Clean Water Act (William Jackson, National Park Service hydrologist, Washington Office Water Resources Division, pers. comm. 1994). The Ute ladies'-tresses recovery plan was inspired by these efforts and is designed to coordinate with and complement programs working toward watershed/ecosystem management.

The following sections of this recovery plan begin with a brief discussion of strategic goals and guidelines for Ute ladies'-tresses recovery and population and habitat restoration. Numbers in parenthesis refer to the recovery task numbers in the stepdown and narrative outlines. Following that, the document describes concepts, and processes for conducting watershed level planning and implementing management guidelines designed to achieve orchid recovery by restoring watershed condition and function. Terms used that are specific to this discussion are defined in Appendix II.[1]

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[1]The approach, terminology, and many of the concepts described in this recovery plan were inspired by and closely follow (in some cases, word for word) the Pre-Decisional Draft Working Document Conservation Strategy for Bull Trout (Salvelinus confluentus). The Conservation Strategy is an interagency

Strategic Goals and Guidelines. Strategic goals for achieving Ute ladies'-tresses population restoration and long-term, natural persistence of the orchid throughout its known historical range include:

1. Maintain options for future recovery by ensuring that secure, well-distributed, and diverse natural habitats and co-adapted populations, and local examples of natural ecosystem processes, remain in place over the long-term;

2. Secure existing populations of riparian and aquatic species, with particular emphasis on sensitive species, and maintain the critical areas supporting healthy ecosystem function;

3. Institute recovery measures that stand the greatest chance of producing measurable improvements in the status and abundance of the orchid and other associated riparian plant species, and improvement of ecosystem function, in the near term.

Population restoration guidelines include:

1. Identifying and securing habitats that are critical for maintaining existing populations of the orchid. (Note: securing includes actions such as purchase, easements, and management agreements that ensure that orchid viability needs are met.)

2. Controlling the cause rather than the symptoms of habitat degradation. In some cases mechanical restoration, such as recreating meander patterns or rerouting the stream back into an historical channel, may be beneficial in the short term to allow long term natural processes to take root.

3. The use of transplanting and ex-situ propagation and reintroduction of stocks of the orchid should only be used as a last resort or to restore extirpated populations and should be avoided where reproductive potential remains.

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effort involving the U.S. Fish and Wildlife Service Idaho Field Office, the Bureau of Land Management Idaho State Office, Regions 1 and 4 of the U.S. Forest Service, and the State of Idaho. The strategy was prepared by a Technical Work Group that included representatives from the U.S. Forest Service, Idaho Department of Fish and Game, Bureau of Land Management, Idaho Division of Environmental Quality, and the U.S. Fish and Wildlife Service. The Ute ladies'-tresses orchid Recovery Team would like to acknowledge and express appreciation for the contribution made by the interagency group that authored the Bull Trout Conservation Strategy. The document is an excellent example of ecosystem-level thinking applied to restoration and management of a species in trouble.

The following comments from FEMAT (1993) broadly explain why specific numeric objectives have not been developed for the Ute ladies'-tresses recovery plan:

> "The wide range of natural variation of individual stream habitat variables and the complex, and little understood interplay between these...makes it difficult to establish relevant quantitative management directives from habitat features. It is also difficult to quantify direct linkages among processes and functions outside the stream channel to in-channel conditions and biological variables.
>
> Structural components of stream habitat must not be used as management goals in and of themselves. No target management or threshold level for these habitat variables can be uniformly applied to all streams. While this approach is appealing in its simplicity, it does not allow for natural variation among streams .... Furthermore, attaining the predetermined values does nothing to insure aquatic ecosystem processes are protected. These habitat parameters must be viewed collectively as part of the larger issue of watershed health and maintenance of natural physical and biological integrity."

It is not possible at this time to define clear limits or thresholds in habitat conditions that directly control the distribution and population size of the Ute ladies'-tresses. Further research will allow better definition and quantification of desirable habitat conditions and how to achieve them. This recovery plan describes a process through which the rather general strategic goals just discussed can be further refined, defined, quantified, and implemented.

Recovery Implementation. Recovery goals and actions are conceived as occurring at several scales. The broadest scale of recovery planning and implementation will take place at the key watershed scale. Recovery actions will focus on determining and implementing management practices that retain and restore watershed health and function. Within key watersheds, more specific watershed management actions will be directed at drainages containing occurrences of the orchid and critical contributing areas. Finally, site-specific riparian management objectives will be developed and implemented for specified areas within drainages that require special management attention.

This plan recommends that an interdisciplinary team (ID Team) be assembled for each watershed. The ID Team will conduct an evaluation of the cumulative effects of resource management and land use practices on watershed function and orchid populations and habitat. Following the evaluation, the ID Team will make management recommendations and determine management objectives applicable at the watershed, drainage, or site-specific level. The ID Team will also develop standards and guidelines for achieving management objectives and by which proposed and ongoing management actions can be evaluated for their impact on watershed goals and orchid recovery. The management objectives and standards and guidelines should be developed in concert with other programs engaged in sensitive species, riparian area, and watershed resource management. Finally, the ID Team will be responsible for working with public and private resource managers and Federal and state agencies to develop, implement, and monitor management agreements, special land

designations, or other specific actions that accomplish recommended management and recovery objectives. (Task 1.1)

1. Watershed goals. Recovery of the Ute ladies'-tresses will be possible when Key Watersheds are managed to (Task 1):

   a. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection and restoration of the dynamic riparian, aquatic, and wetland systems to which species, populations, and communities are uniquely adapted.

   b. Maintain and restore spatial and temporal connectivity within and between drainages. Lateral, longitudinal, and drainage network connections include floodplains, riparian areas, wetlands, upslope areas, headwater tributaries, and intact refugia. These linkages must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

   c. Maintain and restore the physical integrity of the riparian and aquatic system, including shorelines, banks, and bottom configurations.

   d. Maintain and restore the natural dynamics of stream systems, including the movement of streams within their floodplains.

   e. Maintain and restore ground water and surface water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its native aquatic and riparian communities.

   f. Maintain and restore the sediment regime in which the riparian and aquatic ecosystem evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

   g. Maintain and restore ground water and in-stream flows sufficient to create and sustain riparian, aquatic, and wetlands habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

   h. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

   i. Maintain and restore the natural species composition and structural diversity of plant communities in riparian zones and wetlands.

j. Maintain and restore habitat to support well-distributed healthy populations of native plant, invertebrate, and vertebrate riparian-dependent species, including the Ute ladies'-tresses.

2. Watershed-Orchid Evaluation.

a. Watershed-Orchid Evaluation is ecosystem planning at both the Key Watershed and Drainage scales (Task 1.2). The intent is to:

1) Determine orchid population and habitat conditions within the watershed.

2) Assess cumulative land use and resource management impacts on watershed/riparian functions with particular emphasis on orchid populations and recovery.

3) Determine the physical and biological processes that effect orchid populations and habitat conditions and delineate Riparian Habitat Conservation Areas and critical contributing areas that will protect the orchid accordingly.

4) Develop Riparian Habitat Management Objectives and Standards and Guidelines for application at the watershed, drainage, and RCHA level.

5) Identify research and information requirements.

6) Identify and prioritize population or habitat recovery and restoration needs.

7) Assess monitoring needs.

b. The specific products resulting from a Watershed-Orchid Evaluation include:

1) Recommendations for population size, levels, and distribution and habitat conditions that should be used as criteria for delisting (Task 1.6).

2) Appropriate boundaries for RHCAs and critical contributing areas (Task 1.3).

3) Values for Riparian Management Objectives (RMOs) and specifications on the scale at which they should be applied (i.e., watershed, drainage, and/or RHCA)(Tasks 1.3, 1.4) .

4) Specific Standards and Guidelines for management and land uses within the watershed, drainage, and RHCAs (Task 1.5).

5) Prioritized list and description of recommended recovery and restoration activities (Task 1.7).

6) Specification of monitoring objectives and methods (monitoring plan)(Task 1.8).

c. Watershed-Orchid Evaluation will include a review of at least:

1) Processes critical to ecosystem function in the watershed, which processes are in place and which are absent, especially hydrology.

2) Landownership within the watershed, along drainages, and in RHCAs and critical contributing areas.

3) Water rights and water uses.

4) Forestry and grazing practices.

5) Recreation use and objectives.

6) Other land uses (e.g., oil and gas leasing, mining).

7) Pollution (both point and non-point sources).

8) Existing and potential natural communities.

9) Identification, status, and location of sensitive species (both plant and animal).

10) Exotic species (both plant and animal).

11) Ongoing and proposed projects that may affect watershed function.

12) Present status of knowledge regarding demographics, population viability, and habitat requirements of the orchid.

3. Interdisciplinary Teams. The products of Watershed-Orchid Evaluation are recommendations that guide and prioritize management actions to achieve the Ute ladies'-tresses recovery goals. Under the ecosystem approach, a technical, interagency, interdisciplinary team (ID Team) conducts the analysis and plays a key role in working with public and private resource managers and Federal and state agencies to implement management recommendations. The ID Team addresses critical issues in the Key Watershed by determining existing stream/riparian and upland conditions, comparing present conditions to potential natural ranges of variability, and making judgements about the effects of historical and current land uses on watershed condition and dynamics and the population size and distribution of the orchid. The ID Team also makes recommendations to the Recovery Team on appropriate delisting criteria, such as population size and distribution and habitat conditions, for the watershed. (Task 1.1)

Interdisciplinary teams to conduct the Watershed-Orchid Evaluation will be assembled as needed. This recovery plan recommends that ID Teams be assembled for each of the watersheds listed in Appendix III. Orchid

populations currently exist in each of these watersheds (see Table 1, page 5).

a. Interdisciplinary Team composition should include the following (Task 1.1):

   1) At least one member of the Ute ladies'-tresses recovery team.

   2) Team members from other recommended disciplines, as appropriate for each particular watershed:
      a) hydrology,
      b) fisheries,
      c) range,
      d) forestry,
      e) recreation,
      f) plant ecology,
      g) entomology,
      h) land use planning, and
      i) other disciplines as appropriate

b. The primary role of the ID Team is to implement the Ute ladies'-tresses recovery plan. In order to implement the recovery plan, the ID team will:

   1) Conduct the Watershed-Orchid Evaluation and provide the products listed above (See Watershed-Orchid Evaluation b)1. through b)6.).

   2) Develop an Action Plan and Implementation Schedule that incorporates the Riparian Management Objectives, Standards and Guidelines, recovery and restoration priorities, and monitoring plan.

   3) Implement the Action Plan by working with public and private resource managers and Federal and state agencies to secure agreements, establish land management designations, carry out recovery and restoration projects, and incorporate the RMOs, Standards and Guidelines, and monitoring plan into agency planning and decision documents.

   4) Develop and implement procedures for evaluating proposed projects for compatibility with RMOs and Standards and Guidelines and making recommendations to managers.

   5) Coordinate with other related watershed management efforts.

   6) Work with the orchid Recovery Team to develop specific recovery goals and delisting criteria for the watershed that can be incorporated into overall recovery goals and delisting criteria for the orchid.

   7) Work with the orchid Recovery Team to develop means for acquiring needed information and conducting research.

8) Monitor and report orchid population and habitat recovery progress to the orchid Recovery Team.

9) Work with public and private resource managers to assure public involvement in development and implementation of watershed goals.

4. Riparian Habitat Conservation Areas (RHCAs). Riparian Habitat Conservation Areas are discrete portions of a drainage that contribute to the creation and maintenance of orchid habitat. Thus the RHCA is the smallest management unit identified by the ID Team. RHCAs will be designed by the ID Team to meet Ute ladies'-tresses recovery goals. At the discretion of the ID Team, RHCAs may be recommended for formal designation as Research Natural Areas, Areas of Critical Environmental Concern, Special Botanic Areas, etc. Ongoing and proposed management activities occurring in or influencing RHCAs will be evaluated for compatibility with Standards and Guidelines and Riparian Management Objectives. Modifications to such activities may be recommended. (Task 1.3)

5. Riparian/Aquatic Habitat Management Objectives (RMOs). Riparian/Aquatic Management Objectives (RMOs) are quantifiable measures of stream, riparian, and wetland condition that define good Ute ladies'-tresses habitat and serve as indicators against which attainment, or progress toward attainment, of orchid recovery goals will be measured. RMOs will be determined by the ID Team as a result of conducting a Watershed-Orchid Evaluation. RMOs are expected to be essentially similar in content for all watersheds, for example, they will likely all address such topics as flow requirements, grazing, recreation, and weed management, timber harvest levels and procedures, etc. However, the specifics of the management objectives will reflect unique conditions and the physical and biological needs and capabilities of each watershed. RMOs may be applicable at the watershed, drainage, and/or RHCA scale. Examples of possible RMOs are listed in Appendix IV. (Task 1.4)

6. Standards and Guidelines. Standards and Guidelines prescribe how Key Watersheds, Drainages, and RHCAs are managed to ensure compatibility with RMOs and Ute ladies'-tresses recovery goals. The ID Team will work with public and private resource managers and Federal and state agencies to ensure that ongoing and proposed projects are evaluated for compatibility with Standards and Guidelines and recommendations made for project modification as appropriate. Standards and Guidelines will be developed by the ID Team as an outgrowth of the Watershed-Orchid Evaluation. (Task 1.5)

The ID Team will work with public and private resource managers and Federal and state agencies to incorporate Riparian Management Objectives and Standards and Guidelines into management decisions. Both the RMOs and the Standards and Guidelines should be designed to allow management flexibility in implementation. As the ID Team will be composed of representatives of several disciplines and planning efforts will be coordinated with other riparian area and watershed management programs and the affected public, management and public acceptance and implementation

of recommended Riparian Management Objectives and Standards and Guidelines is expected.

7. Monitoring Strategy for the Ute ladies'-tresses. Monitoring must be designed to provide information on the recovery status of the Ute ladies'-tresses in Key Watersheds. Results of monitoring should enable managers to see whether or not orchids are achieving and maintaining desired distribution, population size, and viability. Monitoring the effectiveness of the Ute ladies'-tresses Standards and Guidelines will also be needed. If monitoring shows that they have been ineffective, they should be revised. (Task 1.8)

   There are three types of monitoring in this recovery strategy that should be initiated prior to changes in management, and done concurrently throughout the range of the Ute ladies'-tresses. Monitoring objectives, methods, and reporting should be consistent in all watersheds. The ID Teams will be responsible for making sure that monitoring is being conducted and for evaluating the results. The three types of monitoring include:

   a. Population distribution and status (presence-absence and baseline condition).

   b. Effectiveness of the orchid Standards and Guidelines, RMOs, and RHCAs (implementation, compliance, and habitat response).

   c. Effectiveness of recovery efforts (population response).

8. Orchid Recovery in Disjunct Habitats. The above strategy for orchid recovery focuses on orchid occurrences associated with stream systems that are in some way still naturally functioning. The Ute ladies'-tresses orchid also occurs around natural seeps and springs and in wet meadows, only some of which are associated with historic alluvial systems. Human-induced habitat management that mimics natural conditions appears to be important for maintaining or enhancing some of these populations. For example, appropriate hydrology can be created by irrigation, and vegetation community characteristics can be sustained by haying or grazing. The scope of the recovery effort must also include protection and management of these occurrences associated with wet meadows, seeps, and springs. Approximately 50% of the known population occurs in such settings. Recovery objectives for populations in disjunct habitats include:

   a. Securing habitat and habitat conditions necessary to perpetuate the orchid:

      1) purchase, easements, management agreements, special land management designations, etc.;
      2) purchase or obtain water rights and water delivery systems sufficient to maintain hydrologic requirements.

b. Management of soils, hydrology, vegetation, and other habitat features (e.g., pollinators and herbivores) as necessary for orchid viability.

c. Management of human activities (e.g., recreation, irrigation practices) to prevent adverse impacts to or enhance orchid populations and habitat.

d. Monitoring habitat characteristics, orchid populations, and management agreements.

e. Conduct research to better understand the habitat relationships and life history dynamics of orchids in disjunct settings as compared to riparian settings (e.g., how are such settings are colonized, what are the natural habitat conditions required by the orchid in such settings, and what is the natural longevity of orchid occurrences in these settings).

9. Ute ladies'-tresses Recovery Team. Membership on the Ute ladies'-tresses Recovery Team is by appointment of the Service's Regional Director, and the team serves at the discretion of the Regional Director. Often, recovery teams are disbanded once preparation of the recovery plan is completed. However, the Ute ladies'-tresses Recovery Team will not be disbanded when recovery planning is completed, but will continue to assist the Service in:

a. Overseeing the establishment of the watershed ID Teams.

b. Providing guidance to the ID Teams, including participating as a representative of the Recovery Team on the ID Team.

c. Assessing recommended population and habitat recovery goals and delisting criteria for the orchid in each watershed and incorporating them into overall recovery goals and delisting criteria for the orchid throughout its range.

d. Reviewing progress toward recovery, as reported by the ID Teams, at least annually and until such time as the orchid is delisted or the recovery process is sufficiently institutionalized that such oversight is redundant.

e. Guiding, implementing, and evaluating recovery actions for Ute ladies'-tresses populations in disjunct habitats.

f. Guiding, implementing, and evaluating recovery actions for all Ute ladies'-tresses populations in the interim before watershed ID Teams are established, Watershed-Orchid Evaluations are conducted, and Resource Management Objectives and Standards and Guidelines are developed.

g. Identifying sources and helping pull together resources for acquiring needed information and conducting necessary research.

Summary. The previous discussion outlines concepts and procedures for achieving Ute ladies'-tresses recovery through improvement of watershed condition and function. The focus on watershed level planning and management is necessary because it is watershed conditions and processes that create and maintain orchid habitat and thus assure perpetuation of orchid populations. The recovery effort will be accomplished through an interagency, interdisciplinary, watershed evaluation, planning, and management effort. An interagency, interdisciplinary team will evaluate key watersheds, recommend orchid recovery goals and delisting criteria appropriate for the watershed, recommend management objectives, develop standards and guidelines for achieving management objectives, create an action plan for implementation of management objectives and standards and guidelines, and work with public and private resource managers and Federal and state agencies to craft and secure the necessary land management designations and management agreements to implement the action plan and affect recovery of the orchid. Orchid recovery efforts will be coordinated with other programs designed to improve the condition or status of other sensitive species and riparian and aquatic ecosystems. Where orchid populations occur in habitats not connected with current watershed processes, their protection and management will be directed by the orchid Recovery Team and will involve site-specific actions. These disjunct populations will be protected and managed until such time as the species is recovered or the populations are no longer considered essential for orchid recovery. The orchid Recovery team will incorporate orchid population and habitat recovery goals recommended for each watershed into overall population and habitat recovery goals and delisting criteria. The orchid Recovery Team will also solicit and oversee research efforts to acquire the necessary information to set specific, quantifiable, management and population targets and assess progress toward them.

B. Stepdown Outline for Recovery Actions

1. Define, manage, and restore watersheds.

    1.1 Assemble Interdisciplinary Teams.

    1.2 Conduct Watershed-Orchid Evaluation.

    1.3 Define and delineate Riparian Habitat Conservation Areas and Critical Contributing Areas.

    1.4 Develop Riparian/Aquatic Management Objectives (RMOs).

    1.5 Develop Standards and Guidelines.

    1.6 Determine population and habitat recovery goals for the watershed to use as criteria for delisting.

    1.7 Identify, describe, and prioritize watershed, riparian habitat, and orchid population recovery and restoration projects.

    1.8 Establish monitoring objectives and design a monitoring plan.

1.9 Develop an Action Plan and Implementation Schedule for establishing RMOs and Standards and Guidelines and carrying out recovery and restoration projects and the monitoring program.

1.10 Work with public and private resource managers and Federal and state agencies to implement the action plan.

1.11 Evaluate ongoing activities for compatibility with RMOs and Standards and Guidelines, recommend modifications as appropriate.

1.12 Evaluate progress and report to the orchid Recovery Team.

2. **Implement interim recovery actions for orchid populations associated with natural stream systems.**

3. **Identify, protect, and manage populations in disjunct habitats.**

4. **Develop orchid population and habitat recovery goals and delisting criteria.**

5. **Inventory remaining potential habitat.**

6. **Conduct genetic, life history, ecology, and habitat management studies.**

6.1 Conduct genetic studies.

6.2 Develop propagation and transplanting protocols.

6.3 Conduct life history and demographic studies.

6.4 Conduct ecology studies.

6.5 Conduct habitat and watershed management studies.

7. **Reintroduce Ute ladies'-tresses into appropriate sites.**

7.1 Evaluate sites where historic occurrences may have been extirpated for possible reintroduction.

7.2 Implement reintroductions.

7.3 Protect, manage, and monitor reintroduced populations.

8. **Conduct public education on watershed and riparian ecosystem management, use of recovery and interdisciplinary teams, and orchid ecology.**

C. Narrative Outline for Recovery Actions

1. **Define, manage, and restore watersheds.** A full description of the rationale and recommended procedures for accomplishing this recovery action, including the steps listed below, are included in the body of the text and will not be repeated here.

   1.1 Assemble Interdisciplinary Teams. (see #3., page 23)

   1.2 Conduct Watershed-Orchid Evaluation. (see #2., page 22-23)

   1.3 Define and delineate Riparian Habitat Conservation Areas and Critical Contributing Areas. (see #4., page 25)

   1.4 Develop Riparian/Aquatic Management Objectives (RMOs). (see #5., page 25)

   1.5 Develop Standards and Guidelines. (see #6., page 25)

   1.6 Determine population and habitat recovery goals for the watershed to use as criteria for delisting. (see #2.,b.,1), page 22)

   1.7 Identify, describe, and prioritize watershed, riparian habitat, and orchid population recovery and restoration projects. (see #2.,b.,5), page 22)

   1.8 Establish monitoring objectives and design a monitoring plan. (see #2.,b.,6), page 23)

   1.9 Develop an Action Plan and Implementation Schedule for establishing RMOs and Standards and Guidelines and carrying out recovery and restoration projects and the monitoring program. (see #3.,b., page 24)

   1.10 Work with public and private resource managers and Federal and state agencies to implement the action plan. (see #3.,b., page 24)

   1.11 Evaluate ongoing activities for compatibility with RMOs and Standards and Guidelines, recommend modifications as appropriate. (see #7, page 26)

   1.12 Evaluate progress and report to the orchid Recovery Team. (see #3.,b., page 24 and #9, page 27)

2. **Implement interim recovery actions for orchid populations associated with natural stream systems.** Assembling ID Teams, conducting watershed evaluation, and developing and implementing management recommendations is expected to take from 6 months to 1 year following final approval of this recovery plan. Every effort should be made to expedite that process. During the interim, however, recovery actions should occur. Recovery actions should be directed toward protecting known populations and maintaining or enhancing habitat conditions for the orchid. Actions can

include identifying areas for acquisition or special management designations, applying integrated weed control and vegetation management, assuring that hydrologic requirements are met and that proposed projects will not compromise them, managing grazing to avoid impacts during sensitive times of the year (during flowering and fruit set), and managing recreation and other activities to avoid trampling, compaction, and other adverse impacts to habitat. Some type of population and habitat monitoring should be initiated in each watershed until such time as a complete monitoring plan is designed and implemented.

3. **Identify, protect, and manage populations in disjunct habitats.** Watershed ID Teams will be focusing their attention on recovery of the orchid in habitats created and maintained by natural hydrologic systems. However, occurrences of the orchid outside of those areas must be protected and managed as well. Recovery actions should include acquisition, special land management designations, and management agreements to manage habitat, securing water rights or negotiating quantities and timing of flow (e.g., from irrigation systems), and vegetation, grazing, and recreation management. Population and habitat monitoring should also be conducted.

4. **Develop orchid population and habitat recovery goals and delisting criteria.** Watershed ID Teams will make recommendations for orchid population sizes and distribution and habitat conditions that should be attained within the watershed for recovery and delisting of the orchid. These recommended recovery goals for each watershed will need to be integrated with each other and incorporated into overall recovery goals and delisting criteria for the orchid throughout its range.

5. **Inventory remaining potential habitat.** Recent discoveries of the orchid have extended its known range northward to include the North Platte River drainage in Wyoming and areas between there and Colorado Springs along the Front Range of Colorado (See Figure 1 for locations of known and historical occurrences). Recovery of the orchid cannot be complete until the full range and habitat preferences of the orchid are understood and the genetic and ecological relationships within and between populations elucidated. Priority areas for additional inventory include: the headwaters of the North Platte River, the Laramie Basin, and the upper Green River and its tributaries in Wyoming; drainages along the Front Range north of Boulder, Colorado, including within the Pawnee National Grasslands; along the Green River and its tributaries between Brown's Park (in Colorado and Utah) and Jensen, Utah; and portions of the Colorado River and its tributaries in Colorado and Utah. Drainages, seeps, and springs in the eastern Great Basin of Utah and Nevada should also be inventoried, especially since an historical location at Willow Springs in far western Utah was recently reconfirmed.

6. **Conduct genetic, life history, ecology, and habitat management studies.** In order to assess and maintain the full genetic variability inherent in this species, know how to establish and maintain minimum viable populations, and understand how to assess and manage orchid habitat, genetic, population biology, ecology, and habitat management studies are necessary.

6.1 Conduct genetic studies. It is important to determine the genetic complement of the Ute ladies'-tresses and understand genetic variability within and between populations. Studies should be conducted to acquire this information and incorporate it into conservation and recovery planning.

6.2 Develop propagation and transplanting protocols. Studies should be conducted to develop protocols for propagation and transplanting. The process of and requirements for germination and maturation to reproducing adults in orchids are complex and poorly understood, and for this species, completely unknown. Many orchids develop a symbiotic relationship with soil fungi and may exist as symbionts underground for many years. Understanding the requirements and developing protocols for propagation and transplanting will be useful for mitigation planning, maintaining genetic stock, augmenting declining populations, and possible reintroductions.

6.3 Conduct life history and demographic studies. Research should be conducted on pollination biology, breeding systems, life history, and demographics. Demographic studies should focus on identifying the most vulnerable life history stages and determining what factors contribute to that vulnerability. Demographic studies should also elucidate the age structure or composition of viable populations and how can it be measured or assessed. This information is necessary in order to design and evaluate population monitoring programs and set population targets for recovery.

6.4 Conduct ecology studies. Research should be conducted on habitat requirements of the orchid and responses of various life stages to critical habitat features. This information is necessary in order to design and evaluate habitat management programs and predict the consequences of habitat alterations on long term viability.

6.5 Conduct habitat and watershed management studies. Research should be conducted on how to create, rehabilitate, maintain, and manage habitat. The orchid appears to require early to mid-seral riparian habitats created and maintained by streams active within their floodplains. Research is needed on relationships between watershed condition and management and creation and maintenance of habitat for the orchid, with particular focus on how watershed condition and management influence stream movement within floodplains. Studies should also focus on geomorphology, hydrography, and groundwater and stream hydrology and how they influence riparian area soil moisture and vegetation communities. Additional research is needed on special management needs of riparian, wet meadow, seep, and spring vegetation communities so that grazing, weed, and recreation management programs can be designed and evaluated. Information from these studies will be used to develop habitat management objectives.

7. **Reintroduce Ute ladies'-tresses into appropriate sites.** The orchid has been extirpated from portions of its known historic range. To complete its distribution within it known historic range, orchids should be reintroduced into appropriate sites.

   7.1 Evaluate sites where historic occurrences may have been extirpated for possible reintroduction. There are several sites throughout the known historic range of the orchid where populations have been extirpated or have not been seen for many years. These areas need additional inventory to verify the presence or absence of the orchid. Where the orchid is verified as having been extirpated, sites should be evaluated for possible reintroduction. Evaluations should consider site potential from an ecological as well as protection perspective (i.e., are site conditions suitable for the orchid now and in the future, are these conditions able to be maintained naturally now and in the future, and are the site and habitat conditions (such as hydrology) under ownership or management that can guarantee protection in perpetuity). Reintroduction sites should also be selected to complete the historical distribution of the orchid, contribute to the natural biodiversity of the area, and offer the potential for public education and research.

   7.2 Implement reintroductions. Using protocols and knowledge acquired in step 5, reestablish populations at selected sites. This step will include a genetic analysis to select sources of seeds or transplants that will maximize the potential for long term viability of the reintroduced populations and the entire species.

   7.3 Protect, manage, and monitor reintroduced populations. It will be necessary to establish management agreements and implement monitoring plans to assure the long term viability and protection of reintroduced populations.

8. **Conduct public education on watershed and riparian ecosystem management, use of recovery and interdisciplinary teams, and orchid ecology.** Ecosystem management to preserve biodiversity is still a foreign concept to resource managers and may be misunderstood and viewed with hostility by the general public. Effective recovery of the orchid requires that public agencies and the general public work together to make and carry out management decisions and work for long-term natural function of watersheds. This recovery strategy, with its focus on interdisciplinary and interagency coordination, communication, and teamwork and flexible management guidelines, offers the opportunity to accomplish orchid protection and recovery without excessive acrimony. Every effort should be made to learn from this endeavor and teach others about the process and its accomplishments.

D. Literature Cited/References

Ames, O. 1905. A synopsis of the genus Spiranthes north of Mexico: Orchidaceae. Fascicle I, pages 122-156.

Arditti, J. 1992. Fundamentals of orchid biology. John Wiley and Sons, New York, New York. 691 pp.

Arft, A. 1993. Demongraphics, ecology, and management needs of the threatened orchid Spiranthes diluvialis (Sheviak). Report for Colorado Natural Areas Program, December, 1993. 36 pp.

Arft, A. and T.A. Ranker. 1993. Population genetics and phylogenetic systematics of the rare orchid Spiranthes diluvialis: implications for conservation. Pages 264-269 in R. Sivinski and K. Lightfoot, eds. Proceedings of the Southwest Rare and Endangered Plant Conference. Miscellaneous Publication No. 2. New Mexico Forestry and Conservation Division. Santa Fe, New Mexico.

Arnow, L.A., B.J. Albee & A.M. Wyckoff. 1980. Flora of the central Wasatch Front, Utah. University of Utah Press, Salt Lake City. 663 pp.

Belovsky, G.E., J.A. Bissonette, R.S. Dueser, T.C. Edwards, Jr., C.M. Luecke, M.E. Ritchie, J.B. Slade, and F.H. Wagner. 1994. Management of small populations: concepts affecting the recovery of endangered species. Wildl. Soc. Bull. 22(2):307-316.

Correll, D.S. 1950. Native orchids of North America north of Mexico. Chronica Botanica, Waltham, Massachusetts. 400 pp.

Coyner, J. 1989. Status check on reported historic populations of Spiranthes diluvialis. Memorandum, U.S. Fish and Wildlife Service, Salt Lake City, Utah. 9 pp.

Coyner, J. 1990. Population study Spiranthes diluvialis. Report for Bureau of Land Management, Salt Lake City, Utah. 29 pp.

Coyner, J. 1991. Spiranthes diluvialis supplemental status report. Report for U.S. Fish and Wildlife Service, Salt Lake City, Utah. 1 p.

Cronquist, A., A.H. Holmgren, N.H. Holmgren, J.L. Reveal & P.K. Holmgren. 1977. Intermountain flora, vol. 6. New York Botanical Garden and Columbia University Press, New York. 584 pp.

Dressler, R. 1981. The orchids. Harvard University Press, Cambridge, Massachusetts. 332 pp.

England, J.L. 1992. Endangered and threatened wildlife and plants; final rule to list the plant Spiranthes diluvialis (Ute lady's-tresses) as a threatened species. Federal Register 57(12):2048-2054.

Forest Ecosystem Management Assessment Team (FEMAT). 1993. Forest ecosystem management: an ecological, economic, and social assessment. U.S.D.A. Forest Service, Portland, Oregon. 9 chapters.

Franklin, M.A. 1993. Report for 1992 joint challenge cost share project Ashley National Forest and Section 6 agreement U.S. Fish and Wildlife Service, target species: Ute ladies'-tresses (Spiranthes diluvialis Sheviak). Utah Natural Heritage Program, Salt Lake City, Utah. 22 pp. plus appendices.

Futuyma, D.J. 1986. Evolutionary biology. Sinauer Associates, Sunderland, Massachusetts. 600 pp.

Galloway, G.E. (exec. dir.). 1994. Report of the Interagency Floodplain Management Review Committee to the Administration Floodplain Management Task Force - "Sharing the Challenge: Floodplain Management into the 21st Century". Washington, D.C. 189 pp. plus appendices.

Goodrich, S. & E. Neese. 1986. Uinta Basin flora. U.S.D.A. Forest Service, Ogden, Utah. 320 pp.

Grant, V. 1971. Plant speciation. Columbia University Press, New York. 435 pp.

Grossman, G.D. 1994. Some thoughts on the relationship between habitat structure in lotic environments and the conservation on evolutionarily significant units. Pages 59-60 in Program and Abstracts of a Conference on Evolution and the Aquatic Ecosystem, Defining Unique Units in Population Conservation. American Fisheries Society/Fisheries Action Network.

Heil, K.D. 1988. Endangered, threatened, rare and other plants of concern, Capitol Reef National Park, Utah. Report for National Park Service, Torrey, Utah. 57 pp.

Jennings, W.F. 1989. Final report. Species studied: Eustoma grandiflorum, Spiranthes diluvialis, Malaxis brachypoda, Hypoxis hirsuta, Physaria bellii, Aletes humilis. Report for The Nature Conservancy under the Colorado Natural History Small Grants Program. The Nature Conservancy, Boulder, Colorado. 48 pp.

Jennings, W.F. 1990. Final Report. Species studied: Spiranthes diluvialis, Sisyrinchium pallidum. Report for The Nature Conservancy under the Colorado Natural History Small Grants Program. The Nature Conservancy, Boulder, Colorado. 29 pp.

Luer, C.A. 1975. The native orchids of the United States and Canada excluding Florida. New York Botanical Garden, New York. 363 pp.

Magrath, L.K. 1973. The native orchids of the prairies and plains region of North America. Ph.D. Dissertation. University of Kansas, Lawrence, Kansas. 284 pp.

Martin, L. and J. Wagner. 1992. Hydrologic conditions related to the Hog Canyon riparian restoration project, Dinosaur National Monument. National Park Service Technical Report NPS/NRWRD/NRTR-92/13, Fort Collins, Colorado. 32 pp.

McClaren, M.P. and P.C. Sundt. 1992. Population dynamics of the rare orchid Spiranthes delitescens. Southwestern Naturalist 37(3):299-333.

Prichard, D. 1993. Riparian area management. Process for assessing proper functioning condition. Technical Reference 1737-9. U.S.D.I. Bureau of Land Management Service Center, Denver, Colorado. 51 pp.

Reeves, G.H., J.R. Sedell, L.E. Brenda, and P.A. Bisson. 1994. A disturbance-based ecosystem approach to maintaining and restoring freshwater habitat for anadramous salmonids. Pages 52-53 in Program and Abstracts of a Conference on Evolution and the Aquatic Ecosystem, Defining Unique Units in Population Conservation. American Fisheries Society/Fisheries Action Network.

Riedel, L. 1992. Hog Canyon riparian rehabilitation project baseline data collection: 1991 Dinosaur National Monument. Report for National Park Service Dinosaur National Monument. 57 pp.

Rydberg, P. 1906. Flora of Colorado. Bul. 100, The Agricultural Experiment Station, Colorado Agricultural College. __ pp.

Schemske, D.W., B.C. Husband, M.H. Ruckelshaus, C. Goodwillie, I.M. Parker, and J.G. Bishop. 1994. Evaluating approaches to the conservation of rare and endangered plants. Ecology 75(3):584-606.

Sheviak, C.J. 1973. A new Spiranthes from the grasslands of central North America. Botanical Museum Leaflet of Harvard University 23:285-297.

Sheviak, C.J. 1982. Biosystematic study of the Spiranthes cernua complex. New York State Museum Bulletin 448. 73 pp.

Sheviak, C.J. 1984. Spiranthes diluvialis (Orchidaceae), a new species from the western United States. Brittonia 36(1):8-14.

Sheviak, C.J. 1989. A new Spiranthes (Orchidaceae) from Ash Meadows, Nevada. Rhodora 91:225-234.

Sheviak, C.J. 1990. A new Spiranthes (Orchidaceae) from the cienagas of southernmost Arizona. Rhodora 92:213-231.

Sheviak, C.J. and P.M. Catling. 1980. The identity of Spiranthes ochroleuca (Rydberg) Rydberg. Rhodora 82:525-562.

Sipes, S.E., V.J. Tepedino, and W.R. Bowlin. 1993. The pollination and reproductive ecology of Spiranthes diluvialis Sheviak (Orchidaceae). Pages 320-333 in R. Sivinski and K. Lightfoot, eds. Proceedings of the Southwest

Rare and Endangered Plant Conference. Miscellaneous Publication No. 2. New Mexico Forestry and Conservation Division. Santa Fe, New Mexico.

Stone, R.D. 1993. Final report for the 1992 challenge cost share project, Uinta and Wasatch-Cache National Forests, target species: Ute ladies'-tresses orchid (Spiranthes diluvialis Sheviak). Utah Natural Heritage Program, Salt Lake City, Utah. 27 pp. plus appendices.

Technical Work Group. 1994. Pre-decisional draft working document. Conservation strategy bull trout (Salvelinus confluentus). U.S.D.A. Forest Service, Portland, Oregon. 55 pp.

U.S. Fish and Wildlife Service. 1991. Spiranthes diluvialis supplemental status report. U.S. Fish and Wildlife Service, Salt Lake City, Utah. 3 PP.

U.S.D.A. Forest Service and U.S.D.I Bureau of Land Management. 1994. Environmental assessment. Interim strategies for managing anadromous fish-producing watersheds on Federal lands in eastern Oregon and Washington, Idaho, and portions of California. U.S.D.A. Forest Service, Portland, Oregon. 68 pp. plus appendices.

U.S.D.I. Bureau of Land Management. 1990. Riparian-wetland initiative for the 1990's. U.S.D.A. Bureau of Land Management, Washington, D.C. 51 pp.

Wells, T.C.E. 1967. Changes in a population of Spiranthes spiralis (1) Chevall. at Knocking Hoe National Nature Reserve, Bedfordshire, 1962-65. Journal of Ecology 55:83-99.

Wells, T.C.E. 1981. Population ecology of terrestrial orchids. Pages 281-195 In H. Synge, ed. The Biological Aspects of Rare Plant Conservation. John Wiley and Sons, Ltd. London.

Welsh, S.L., N.D. Atwood, S. Goodrich, and L.C. Higgins. 1987. A Utah flora. Great Basin Naturalist Memoirs, Number 9. Brigham Young University, Provo, Utah. 894 pp.

PART III IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and estimated costs for the recovery program. It is a guide for meeting the objective discussed in Part II of this Plan. This schedule indicates task priorities, task numbers, task descriptions, duration of tasks, the responsible agencies, and lastly, estimated costs. These actions, when accomplished, should bring about the recovery of the species and protect its habitat. It should be noted that the estimated monetary needs for all parties involved in recovery are identified and, therefore, Part III reflects the total estimated financial requirements for the recovery of this species. Priorities in Column one of the following implementation schedule are assigned as follows:

Priority 1: An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2: An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

Priority 3: All other actions necessary to meet the recovery objective.

Key to Acronyms used in Implementation Schedule

BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BOS	City of Boulder Open Space Department
BR	Bureau of Reclamation
CNAP	Colorado Natural Areas Program
CNHP	Colorado Natural Heritage Program
CNPS	Colorado Native Plant Society
COE	Corps of Engineers
CPC	Centers for Plant Conservation (either Red Butte Gardens or Denver Botanic Gardens)
CUP	Central Utah Project
FS	U.S. Forest Service
FWS	U.S. Fish and Wildlife Service ES - Ecological Services RW - Refuges and Wildlife
JEFFCO	Jefferson County Open Space
NPS	National Park Service, Dinosaur National Monument or Capital Reef National Park
NNHP	Nevada Natural Heritage Program
RT	Ute ladies'-tresses Recovery Team
TEAM	Interdisciplinary Team (ID Team)
TNC	The Nature Conservancy (CO, UT, or WY Field Offices)
UCB	University of Colorado at Boulder
UNHP	Utah Natural Heritage Program
USDA	U.S. Dept. of Agriculture Bee Biology Laboratory
UTE	Uintah and Ouray Ute Indian Tribe
WNDDB	Wyoming Natural Diversity Data Base (Natural Heritage Program)
WY	State of Wyoming

PART III IMPLEMENTATION SCHEDULE
UTE LADIES'-TRESSES ORCHID

PRIORITY NUMBER	TASK NUMBER	TASK DESCRIPTION	TASK DURATION (YEARS)	RESPONSIBLE AGENCY FWS REGION	FWS PROGRAM	OTHER	COST ESTIMATES (x $1,000) FY-01	FY-02	FY-03	COMMENTS/NOTES
1	1.1	Assemble interdisciplinary teams	0.5	6	ES, RW	BIA, BLM, BOS, BR, CNAP, CNHP, FS, JEFFCO, NPS, UNHP, UTE, WYO	5	---	---	
1	1.2	Conduct watershed-orchid evaluation	0.5			TEAM	45	---	---	
1	1.3	Define RHCAs & Critical Contributing Areas	0.5			TEAM	***			*** included in watershed evaluation budget
1	1.4	Develop RMOs	0.5			TEAM	***			*** included in watershed evaluation budget
1	1.5	Develop Standards & Guidelines	0.5			TEAM	***			*** included in watershed evaluation budget
1	1.6	Develop population & habitat recovery goals	1.0			TEAM	***			*** included in watershed evaluation budget
1	1.7	Identify and develop restoration projects	0.5			TEAM	***			*** included in watershed evaluation budget
1	1.8	Design monitoring plan	0.5			TEAM	***			*** included in watershed evaluation budget
1	1.9	Develop Action Plan & Implementation Schedule	0.5			TEAM	***			*** included in watershed evaluation budget
1	1.10	Work with public/private resource managers to implement action plan	20	6	ES, RW	BIA, BLM, BOS, BR, CNAP, CNHP, FS, JEFFCO, NPS, UNHP, UTE, WNNDB, WYO		***		*** not determinable
1	1.11	Evaluate ongoing activities	**			TEAM		***		** ongoing *** not determinable
1	1.12	Evaluate progress	20			TEAM		***		*** not determinable
1	2	Implement interim recovey actions	1	6	ES, RW	BIA, BLM, BOS, BR, CNAP, CNHP, CUP, FS, JEFFCO, NPS, UNHP, UTE, WNDDB, WYO		***		*** not determinable

PRIORITY NUMBER	TASK NUMBER	TASK DESCRIPTION	TASK DURATION (YEARS)	RESPONSIBLE AGENCY FWS REGION	FWS PROGRAM	OTHER	COST ESTIMATES (x $1,000) FY-01	FY-02	FY-03	COMMENTS/NOTES
1	3	Identify, protect, & manage disjunct habitats	20	6	ES, RW	BIA, BLM, BOS, BR, CNAP, CNHP, CUP, FS, JEFFCO, NPS, UNHP, UTE, WNNDB, WYO		***		*** Not determinable
1	4	Develop recovery goals & delisting criteria	3			RT	5	5	5	
1	6.1	Conduct genetic studies	5			UCB	20	20	20	
1	6.3	Conduct life history & demographic studies	20			BLM, BOS, CNAP, CNPS, CPC, CUP, FS, JEFFCO, NPS, UNHP, USDA, WNNDB	20	20	20	
1	6.4	Conduct ecology studies	10			BLM, BOS, CNAP, CUP, FS, JEFFCO, NPS, UNHP	20	20	20	
1	6.5	Conduct habitat management studies	15			BLM, BOS, CNAP, CUP, FS, JEFFCO, NPS, TNC, UNHP	20	20	20	
2	5	Inventory remaining potential habitat	5	1, 6	ES, RW	BIA, BLM, BOS, BR, CNAP, CNHP, CNPS, CUP, JEFFCO, NPS, NNHP, UNHP, UTE, WNDDB, WYO	20	20	20	
2	6.2	Develop propagation & transplanting protocols	10			CPC, UCB	15	15	15	
2	8	Conduct public education	**	1, 6	ES, RW	BIA, BLM, BOS, BR, CPC CNAP, CNHP, CNPS, CUP, JEFFCO, NPS, NNHP, TNC, UCB, UNHP, UTE, WNDDB, WYO	5	5	5	** ongoing
3	7.1	Evaluate sites for reintroduction	3	1, 6	ES, RW	CPC, TEAM	3	3	3	
3	7.2	Implement reintroductions	1	1, 6	ES, RW	CPC, other		***		*** not determinable
3	7.3	Protect, manage reintroduced populations	10			TEAM, other		***		*** not determinable

PART IV APPENDICES

Appendix I. Taxonomy of Ute ladies'-tresses

Nineteenth and early twentieth century problematic collections from Nebraska, Colorado, Utah, and New Mexico were reported in the literature as one or more of the above taxa and some herbarium specimens had multiple annotations as different taxa. Prior to studies on the genus Spiranthes initiated by Charles J. Sheviak in the early 1970's, the major works on the genus were contributed by Ames (1905), Correll (1950), and Luer (1975), whose opinions on the genus differed substantially. The delimitation of species in Spiranthes is often difficult due to the lack of distinctive morphological characters that preserve well in the herbarium and the postulated occurrence of hybridization.

The correct treatment for problematic collections is as follows:

A specimen collected along the North Platte River on September 22, 1859, by Henry Engelmann and previously identified as Spiranthes cernua, is S. magnicamporum. A specimen also collected by Henry Engelmann on an unspecified day in September, 1856, along South Platte River was actually taken in Weld or Morgan Counties, Colorado, and is S. diluvialis. Attributed to Nebraska, it, too, was previously identified as S. cernua.

Collections from the Rio Grande Valley and Española (Rio Arriba County), New Mexico, attributed to S. cernua by Ames (1905), Correll (1950), and Holmgren in Cronquist (1977) --Cronquist et al. ???? are S. magnicamporum as shown by Luer (1975). The "Camp Harding, near Pikes Peak" collection cited by Rydberg (1906) as S. porrifolia, is in fact S. diluvialis, collected in what is now suburban Colorado Springs.

All specimens of S. porrifolia cited for Nevada have been taken at the eastern foot of the Sierra Nevada, generally near Carson City. It is not at all unusual to find S. porrifolia in this area, which is adjacent to the California state line.

Low-elevation Utah collections, assigned by various workers to S. romanzoffiana (Ames 1905), S. porrifolia (Correll 1950, Holmgren in Cronquist 1977, Luer 1975 and Welsh 1987 --Welsh et al.?????), S. cernua (Correll 1950, Holmgren in Cronquist 1977, and Welsh 1987), and S. magnicamporum (Luer 1975), are S. diluvialis.

Sheviak has published extensively on the taxonomy of genus Spiranthes (Sheviak 1973, 1982, 1984, 1989, 1990, Sheviak and Catling 1980) and has regularly reported cytological data on the genus. The number of chromosomes for species of white-flowered Spiranthes in the United States is based on 15, 22, and 37. Spiranthes magnicamporum, S. ochroleuca, S. odorata, S. lacera, and S. vernalis are all diploids with 2n=30. S. cernua is a polyploid complex presenting numerous forms with 2n=45, 60, or 61 and polyembryonic seeds. Spiranthes lucida, S. romanzoffiana, S. porrifolia, and S. infernalis show 2n=44. Spiranthes delitescens from Arizona shows 2n=74.

Sheviak (1984) reported that counts from three populations of S. diluvialis in Colorado and Utah were uniformly 2n=74. Significantly, meiosis was regular, with the common formation of 37 bivalents. Sheviak concluded that the combination of morphological and cytological data suggests that the plant is an amphiploid derived from hybridization of S. magnicamporum (2n=30) and S. romanzoffiana (2n=44).

The hybridization process described above is technically known as allopolyploidy, and is an important mechanism of speciation in flowering plants. Grant (1971) estimated 47% to 52% of angiosperm species are the result of hybrid/polyploid origin, although this does not take into account speciation at the polyploid level. The duplication of chromosomes giving rise to a polyploid confers "instant" speciation on the new fertile polyploid due to complete reproductive isolation from the parental taxa. Generally, if the two parental species are sufficiently different, the resulting fertile tetraploid will form 2n sets of bivalents, as occurs in S. diluvialis, instead of n sets of irregularly segregating quadrivalents (Futuyma 1986).

A genetic survey employing protein electrophoresis has been conducted on nine populations of S. diluvialis as well as several populations of the putative parental species (Arft and Ranker, 1993). Protein electrophoresis separates isozymes (different forms of an enzyme) in an electric field, thus providing an indirect measure of the genetic makeup of individuals. Generally, isozymes are useful for detecting allopolyploid hybridization because the isozymes present in each of the putative parental species will be combined and detectable in the hybrid species. Results indicate the genetic makeup of S. diluvialis is a combination of those found in S. magnicamporum and S. romanzoffiana (Arft and Ranker, 1993).

Appendix II. Terminology

The following terms are defined for use in this plan:

Critical Contributing Areas - portions of key watersheds that may not directly support habitat for the orchid, but provide conditions that create and maintain habitat for the orchid or other organisms important or detrimental to the orchid. Examples include: important drainage sources of water and sediments; habitat supporting pollinators; and habitat supporting herbivores, weeds, or other potential threats to orchid habitat or populations. Protection and proper management of critical contributing areas is necessary to secure the functional value of orchid habitats.

Disjunct Habitats - areas spatially dissociated from currently extant stream systems but with habitat conditions (principally hydrology) that allow the orchid to exist. These may be areas associated with historical alluvial systems whose hydrology is maintained through irrigation or other conditions that are not now naturally sustainable. To maintain orchid populations in these habitats, special management and preservation of the non-naturally sustainable conditions may be necessary.

Drainage - the individual stream system, including associated headwaters, riparian areas, floodplains, terraces, and uplands, within a key watershed along which occurs one or more subpopulations of the orchid. Management plans and actions applied at the drainage scale are derived from objectives determined during watershed level planning. A list of drainages is included in Appendix I.

Hydrologic Basin - the hydrologic watershed basin encompassing a regional population of Ute ladies'-tresses (the basic ecosystem for the orchid).

Key Watershed - a system of drainages that is essential to the long-term persistence of regionally important Ute ladies'-tresses populations. The key watershed is the scale at which ecosystem management will occur. Key watersheds are designated on the basis of orchid biology and not land ownership. They cross jurisdictional boundaries and may include federal, state, and private land. A list of key watersheds is included in Appendix I.

Riparian/Aquatic Habitat Management Objectives (RMOs) - Riparian/Aquatic Management Objectives (RMOs) are quantifiable goals applicable at the watershed, drainage or RHCA scale, as appropriate. These serve as indicators against which attainment, or progress toward attainment, of orchid recovery goals will be measured. RMOs will be determined by watershed orchid evaluations.

Riparian Habitat Conservation Area (RHCA) - portions of drainages where riparian-dependent natural resources receive primary management emphasis. RHCAs can include orchid occurrences and portions of drainages needed to ensure watershed processes that maintain self-sustaining orchid populations through time. Although RHCAs are where many site-specific management and protection efforts take place, this does not preclude protection efforts at the watershed scale.

Watershed-Orchid Evaluation - A Watershed-Orchid Evaluation, conducted by an interdisciplinary, interagency team, determines cumulative effects of land use activities on orchid populations within the key watershed, and identifies factors limiting these populations. The results of a Watershed-Orchid Evaluation will be used to determine recovery population levels and habitat conditions to use as criteria for delisting and develop and prioritize management recommendations at the watershed, drainage, and RHCA level for achieving these recovery objectives.

Appendix III. Hydrologic Basins and Key Watersheds

Key Watersheds comprise a system of drainages that encompass a regional (or meta) population of the Ute ladies'-tresses. This information is based on current information. Revisions may be necessary based on new data.

BASIN	WATERSHED	DRAINAGE
Green River	Duchesne	Currant Creek
		Duchesne/Rock Creek
		Uinta/White Rocks
		Lake Fork/Yellowstone
	Mainstem Green	Ashley Creek
		Brush Creek
		Dinosaur Nat'l Monument
Mainstem Colorado River	Dirty Devil	Fremont
	Escalante	Deer Creek
Bonneville Basin	Utah Lake	American Fork
		Powell Slough
		Diamond Fork/Spanish Fork
		Provo River
S. Platte River	Boulder Creek/St. Vrain	Boulder Creek
		S. Boulder Creek
		St. Vrain Creek
	Clear Creek	Clear Creek
	Cache LaPoudre River	Poudre River
N. Platte River	Horse Creek	Bear Creek

Appendix IV. Examples of Possible Riparian/Aquatic Management Objectives

Riparian/Aquatic Management Objectives are recommendations for management goals or outcomes. They describe conditions that management decisions can be directed toward achieving. These objectives, as achieved, are considered to be necessary and sufficient to create and maintain habitat essential for Ute ladies'-tresses recovery. These management objectives will be determined by an interdisciplinary, interagency team following an evaluation of watershed condition and needs. The recommendations will be specific to each watershed, and may be applied at the watershed, drainage, or special management area (RHCA) level.

1. Minimum stream flows in stream miles ____ through ____ in XYZ stream shall be greater than or equal to ____ cfs during the following months ____.

2. Dissolved oxygen levels will be maintained at greater than or equal to ____.

3. Peak flows of ____ cfs, or 75% of the natural flow from the watershed, whichever is greater, shall occur sometime between April 15 and June 15, depending upon timing of snowmelt.

4. Sediment loads in stream miles ____ through ____ shall be less than or equal to ____ in XYZ stream.

5. Vegetation community between stream miles ____ and ____ shall contain less than 10% frequency of non-native plant species.

6. The area between stream mile ____ and stream mile ____ and for 300 feet on either side of the center line of the stream shall be designated and managed as a Special Botanical Area to perpetuate the unique plant community there.

7. Acquire, by purchase or exchange, the following parcels ____.

8. Complete a management agreement with landowner W to graze location X from April 1 until May 15.

9. Maintain pollinator habitat in stream reach ____ by ensuring that the vegetation community contains, in sum, at least 20% frequency of species X, Y, and Z.